

## **METAL PALLET STRUCTURE**

### **FIELD OF THE INVENTION**

This invention relates generally to shipping platforms, and more specifically to a metal pallet structure.

### **BACKGROUND OF THE INVENTION**

A pallet is a portable platform typically used to receive a load and to facilitate transport of that load. Pallets are used to support heavy items or equipment, or large

5 numbers of discrete items such as bags or boxes, for movement by a handtruck or forklift. Several industries, including heavy industrial, pharmaceutical, food/grocery, electronics, consumer goods, automotive, hardware, and telecommunications, have specific material handling challenges.

A pallet typically has a load surface for receiving and supporting the load. The load  
10 surface is positioned a distance above ground height, the distance being sufficient to receive the tines of a forklift. Due to the significant weights associated the loads and the nature of the handling by forklifts, the pallets must be able to withstand appropriate, customary use.

In order to meet the stringent requirements of pallet strength, longevity, cleanliness  
15 and storability, pallets have often been formed from wood. A typical pallet is wooden and comprises two planar deck members composed of sheets or individual slats, the deck members being separated by upright supports to allow for insertion of the tines of a handtruck or forklift between the deck members so that the pallet can be raised and moved to a different location. Another common pallet construction comprises a  
20 single deck member supported by legs, the legs being spaced to allow for insertion of the tines beneath the deck member.

The strength of wood is not uniform and, thus, wooden pallets have areas of weakness. Generally, wooden pallets produce about 1.7 turns, meaning that each pallet on average can be depended on for less than two uses before it must be

sacrificed. With this low number of turns, the price of wooden pallets can be significant. Thus, while wooden pallets are cheap to manufacture, they have a limited life under the best circumstances, are readily susceptible to damage and decay, are difficult to dispose of or recycle, and have limited support capacity.

- 5 Plastic pallets have also been used. Although the plastic material is more expensive than wood, they have a relatively simple manufacturing process. As a consequence the overall cost of plastic pallets is generally less than wooden pallets. However, the strength of plastic pallets is generally less than that of wooden pallets. Plastic pallets are brittle particularly in cold environments. When used to transport loads in aircraft,  
10 temperatures at 20,000 feet can cause a plastic pallet to break. When plastic breaks it tends to splinter and therefore offers a considerable risk to users. Further, the plastic material used in the plastic pallets is relatively volatile. Thus, when plastic pallets are stored, they present a fire hazard. OSHA has required that plastic pallets be stored in elaborate sprinkler rooms rather than ordinary warehouses when not in use.
- 15 In light of the problems associated with wooden and plastic pallets, metal pallets have been developed. Metal pallets have a longer life, less likelihood of damage and degradation, and increased support capacity. While metal pallets often have a higher expense, they offer a greater number of turns. A problem with metal pallets is that the pallet itself is heavier and the materials and methods of construction are costlier than  
20 for a wooden pallet. While offering relatively high strength characteristics, metal pallets are very heavy and, consequently, the strength-to-weight ratio is relatively low.

#### **BRIEF SUMMARY OF THE INVENTION**

The present invention relates to a metal pallet structure having features that enhance its strength. One such feature is a stringer adapted for use with the metal pallet. The  
25 stringer is reinforced by a reinforcing beam (or R-beam) and is thus sometimes referred to as an R-beam support structures. The metal pallet structure achieves high

unit load bearing capacities and is itself relatively lightweight. Further, the metal pallet structure is fire and pest resistant.

The present invention relates to a metal pallet structure including strengthening members, specifically R-beam support structures or stringers. The metal pallet  
5 structure has a longitudinally extending length and a laterally extending width. Thus, the metal pallet ends in first and second longitudinal ends and first and second lateral ends.

The metal pallet structure of the present invention includes a top decking comprising a plurality of top deck members and beginning and ending with leading edge  
10 members, a bottom decking comprising at least two bottom deck members, and R-beam support structures or stringers separating the top decking from the bottom decking and supporting the top decking.

The at least two bottom deck members are provided longitudinally, each bottom deck member itself extending laterally. The bottom deck members are generally low  
15 profile and, thus, do not interfere with lift jacks, pallet jacks, etc. The top decking members are also provided longitudinally, each top deck member itself extending laterally. Leading edge members are provided at longitudinal ends of the metal pallet structure and supported by the end top decking members. Advantageously, the leading edge members are easily replaceable. Thus, if the leading edge member is  
20 damaged, for example by the fork of a fork lift, it can be replaced. End R-beam support structures (or stringers) are provided at the lateral ends of the bottom deck members and the top deck members, separating the bottom deck members from the top deck members. The end R-beam support structures include notches for receiving a fork from a fork lift. A central R-beam support structure may be provided  
25 approximately centrally between the lateral ends of the bottom deck members and the top deck members for separating the bottom deck members from the top deck members and providing additional support to the top deck members.

Each R-beam support structure or stringer comprises a support section, an R-beam section and a top section. The support section is generally U-shaped, the bottom of

the U forming the bottom of the R-beam support structure and the side walls of the U extending upwardly therefrom. The R-beam section is also generally U-shaped, the bottom of the U forming a beam extending between the side walls of the support section approximately midway along the length of the side walls of the support  
5 section. The top section is positioned at the top end of the support section side walls and R-beam section side walls. The top section is configured for supporting the top deck members.

In the central R-beam support structures, the top section includes outward extensions extending outwardly passed both side walls of the support section and the R-beam  
10 section and provides a generally planar surface upon which the top deck members may be set.

In the edge R-beam support structure, the top section includes an extension extending outwardly passed one of the side walls, providing a generally planar surface upon which the top deck members may be set. At the opposite side wall, the top section  
15 includes an upward extension extending upwardly from the side wall to form an upward extension of the side wall. At a top point, the upward extension is folded at a 90° angle back towards the other side wall, forming a return extension. The upward extension and the return extension form a pocket for receiving the top deck members.

The beam of the R-beam support structure is provided at a level such that when the  
20 metal pallet structure is engaged by a fork lift, the beam provides additional support. A selected number of fork-receiving notches is provided in at least one of the edge R-beam support structures for receiving a fork from a fork lift. In some pallets, for example, in two-way or four-way entry pallets, appropriate numbers of notches can be provided, from none or two or more. Corresponding notches may be provided in the  
25 central R-beam support structures as well. The notches are provided in both side walls of the support section and extend from the bottom of the U (a portion of the bottom of the U thus being removed) upwardly to the beam of the R-beam section. No portion of the beam is removed. The notches are generally formed as arc.

The R-beam support structures or stringers used with the present invention dramatically increase the load and racking capacity of the metal pallet structure while little additional cost and less than approximately two pounds in additional weight.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 illustrates a perspective view of a metal pallet structure in accordance with

5 one embodiment of the present invention.

Figure 2 illustrates a perspective view of a central R-beam support structure or stringer in accordance with one embodiment of the present invention.

Figure 3 illustrates an end view of the central R-beam support structure of Figure 2.

Figure 4 illustrates a perspective view of an edge R-beam support structure or stringer

10 in accordance with one embodiment of the present invention.

Figure 5 illustrates an end view of the edge R-beam support structure of Figure 4.

Figure 6 illustrates a perspective view of a notch cut into an R-beam support structure in accordance with one embodiment of the present invention.

Figure 7 illustrates a perspective view of a notch formed into an R-beam support

15 structure in accordance with one embodiment of the present invention.

Figure 8 illustrates a perspective view of a central top deck member in accordance with one embodiment of the present invention.

Figure 9 illustrates an end view of the central top deck member of Figure 8.

Figure 10 illustrates a perspective view of an end top deck member in accordance

20 with one embodiment of the present invention.

Figure 11 illustrates an end view of the end top deck member of Figure 10.

Figure 12 illustrates a perspective view of a leading edge member in accordance with one embodiment of the present invention.

Figure 13 illustrates a perspective view of a bottom deck member in accordance with one embodiment of the present invention.

Figure 14 illustrates a perspective view of an end cap in accordance with one embodiment of the present invention.

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### **DETAILED DESCRIPTION OF THE INVENTION**

The present invention relates to a metal pallet structure including strengthening members, specifically R-beam support structures or stringers. References herein to orientations (e.g., up, down, horizontal, vertical, etc.) are provided for convenience and ease of description, and are not intended to be limiting.

- 10 As seen in Figure 1, the metal pallet structure has a longitudinally extending length and a laterally extending width. Thus, the metal pallet ends in first and second longitudinal ends and first and second lateral ends. The metal pallet structure 10 of the present invention includes a top decking 12 comprising a plurality of top deck members 14, 15 and beginning and ending with leading edge members 17, a bottom decking 16 comprising at least two bottom deck members, and R-beam support structures or stringers 18, 20 separating the top decking from the bottom decking. The top decking and bottom decking are generally parallel to one another. End caps 19 are provided for capping the longitudinal ends of the R-beam support structures 18, 20.
- 15
- 20 The metal pallet structure extends in a longitudinal direction and in a lateral direction. Two edge R-beam support structures, or stringers, 18 are provided, one edge stringer 18 being provided on each lateral edge of the metal pallet structure 10 and extending the longitudinal length of the metal pallet structure 10. One or more central R-beam support structures, or stringers, 20 may be provided between the two edge stringers 18
- 25 for additional support.

As seen in Figures 2 through 5, each R-beam support structure, or stringer, 18, 20 comprises a support section 22, an R-beam section 24 and a top section 26. The support section 22, R-beam section 24 and top section 26 may be integrally formed as a single unit or may be formed as separate components. The support section 22 is  
5 generally U-shaped, the bottom 30 of the U forming the bottom of the stringer 18, 20 and the side walls 28 of the U extending upwardly therefrom.

The R-beam section 24 is also generally U-shaped, the bottom of the U forming a reinforcement beam 32 extending between the side walls 28 of the support section 22. In one embodiment, the beam comprises a generally continuous, flat, thin web of  
10 material extending between the side walls 28. In the embodiment shown, the R-beam section 24 is integrally formed with the support section 22. Alternately, the R-beam section 24 may be formed as a separate component that fits within the support section 22 such that the side walls 34 of the R-beam section 24 abut, and co-extend with, the side walls 28 of the support section 22.

- 15 The side walls 28 of the support section 22 and the side walls 34 of the R-beam section 24 together form side walls of the R-beam support structure, or stringer, 18, 20. In one embodiment, the beam 32 of the R-beam section 24 divides the side walls of the stringer 18, 20 approximately centrally such that the side walls 28 of the support section 22 and the side walls 34 of the R-beam section 24 are of  
20 approximately equal dimensions. The side walls of the stringers 18, 20, form a generally hollow central cavity that extends the length of the stringer 18, 20. The beam 32 divides that cavity generally equally. The beam 32 may extend continuously between the walls of the stringer. The beam 32 may be provided with flat upper and lower surfaces or, alternately, may be punctured with apertures.
- 25 The top section 26 is positioned at the top end of the support section side walls 28 and R-beam section side walls 34. The top section 26 is configured for supporting the top deck members. As shown in Figures 2 and 3, in the central R-beam support structures 20, the top section 26 includes outward extensions 36 extending outwardly passed both side walls 34 of the support section 22 and the R-beam section 24 and provides a

generally planar surface 36 upon which the top deck members may be set. As shown, a top portion of each side wall 34 is folded at a 90° angle to form the outward extension 36 extending outwardly from the upwardly extending end portion of the side wall 34. In the embodiment shown, the top section 26 does not extend between the side walls 34. Alternately, the top section 26 may be a separate planar component attached to the side walls 34. Further, the top section 26 may be configured to extend between the side walls 34.

- As shown in Figures 4 and 5, in the edge R-beam support structure, or stringer, 18, the top section 26 includes an extension 36 extending outwardly passed one of the side walls 34a, providing a generally planar surface upon which the top deck members may be set. As shown the top section 26 includes a base 38 extending between the side walls 34a, 34b. At the opposite side wall 34b, the top section 26 includes an upward extension 40 extending upwardly from the side wall 34b to form an upward extension of the side wall 34b. At a top point, the upward extension 40 is folded at a 90° angle back towards the other side wall 34a, forming a return extension 42. The upward extension 40 and the return extension 42 form a pocket 44 for receiving the top deck members 14, 15. In the embodiment shown, the base 38 forms a base of the pocket 44. However, the top section 26 of the edge stringer 18 may alternately be formed without the base 38 extending between the side walls 34a, 34b.
- The beam 32 of the stringer 18, 20 is provided at a level such that when the metal pallet structure 10 is engaged by a fork lift, the beam 32 provides support. As can be seen in Figures 1 and 4, at least one notch 50 is provided in at least one of the edge R-beam support structures, or stringers, 18 for receiving the tines of a fork lift. Corresponding notches 50 may be provided in the central R-beam support structures, or stringers, 20 as well, as shown in Figure 2. The notches 50 are provided in both side walls 28 of the support section 22 and extend from the bottom of the U (a portion of the bottom 34 of the U thus being removed) upwardly to the beam 32 of the R-beam section 24. No portion of the beam 32 is removed. The notches 50 are generally formed as arc and have an upper limit 51. The upper limit 51 of the notch 50 is approximately contiguous with the beam 32. The notches 50 may be formed by

cutting a portion of the stringer 18, 20 or may be formed by deforming a portion of the stringer 18, 20. Figure 6 illustrates a notch 50 formed by cutting a portion of the side walls 28, removing the cut portion of the side walls 28 and the bottom 30. Figure 7 illustrates a notch 50 formed by deforming the side walls 28 and bottom 30.

- 5 The R-beam support structures, or stringers, 18, 20 used with the present invention dramatically increase the load and racking capacity of the metal pallet structure 10 while little additional cost a or weight.

Figures 8 through 11 illustrate a central top deck member 14 and an end top deck member 15. Each of the plurality of top deck members 14, 15 extends laterally, a  
10 series of top deck members being provided in a longitudinal direction to form the top decking. End top deck members 15 are provided at the longitudinal ends of the metal pallet structure 10. Central deck members 14 are provided there between. The top deck members 14, 15 sit on and are received by the R-beam support structures 18, 20. More specifically, lateral ends 60 of the top deck members 14, 15 are received by the  
15 pocket 44 of the edge R-beam support structures 18.

As seen in Figures 8 and 9, each central top deck member 14 comprises three parts: two side portions 62 and one central portion 64. The side portions 62 and central portion 64 may be integrally formed or may be formed as separate components and subsequently assembled. Each side portion 62 has a bottom 66, a top 68, and side  
20 walls 70, a rectangle or square being formed by the bottom 66, top 68 and side walls 70. The rectangle runs the length of the central top deck member 14. As shown, the central portion 64 extends between the two side portions 62, the central portion 64 and the tops 68 of the side portions 62 forming a planar upper surface of the central top deck member 14. Optionally, the central portion 64 may be configured to extend  
25 between the bottoms 66 of the two side portions 62 as well as between the tops 68 of the two side portions 62. Openings 72 may be provided in the top 68 of the side portions 62 to provide access to the bottom 66 of the side portions 62 for the purpose of applying rivets or other fasteners through the bottom 66 of the side portion 62, as

explained below. Further, the central top deck member 14 may be formed in any suitable arrangement so long as strength is not diminished.

Figure 10 and 11 illustrate an end top deck member 15. Each end top deck member 15 comprises three parts: a side portion 62, a central portion 64 and a leading side portion 74. The side portion 62, central portion 64, and leading side portion 74 may be integrally formed or may be formed as separate components and subsequently assembled. The side portion 62 has a bottom 66, a top 68, and side walls 70, a rectangle or square being formed by the bottom 66, top 68, and side walls 70. The rectangle runs the length of the end top deck member 15. The leading side portion 74 includes a bottom 76 and a side wall 78, the side wall 78 being provided towards the inside of the end top deck member 15. The bottom 76 and side wall 78 of the leading side portion 74 together form a ledge for receiving a leading edge member (see Figure 12). As shown, the central portion 64 extends between the side portion 62 and the leading side portion 74, the central portion 64 and the top 68 of the side portion 62 forming a planar upper surface of the end top deck member 15. Optionally, the central portion 64 may be configured to extend between the bottom 66 of the side portion 62 and the bottom 76 of the leading side portion 74. Openings 72 may be provided in the top 68 of the side portion 62 to provide access to the bottom 66 of the side portion 62 for the purpose of applying a rivet or other fastener through the bottom 66 of the side portion 62, as explained below. Further, the end top deck member 15 may be formed in any suitable arrangement providing a receiving area for receiving a leading edge member so long as strength is not diminished.

A leading edge member 17 is shown in Figure 12. The leading edge members 17 are received by the ledge, or other receiving area, of the end top deck member 15.

Consequently, the leading edge member 17 is configured in a manner consistent with the configuration of the ledge. As shown, the leading edge member 17 is formed generally rectangularly, having a top 80, a bottom 82, a leading side 84 and an inner side 86. The rectangle formed by the top 80, bottom 82, leading side 84 and inner side 86 may be hollow, as shown, or may be solid. If hollow, openings 88 (as many as wanted, (e.g., 2 as shown)) may be provided in the top 80 of the leading edge member

17 to provide access to the bottom 82 of the leading edge member 17 for the purpose  
of applying a rivet, screw or other fastener through the bottom 82 of the leading edge  
member 17, as explained below. The top 80 and the leading side 84 may be textured,  
such as with a series of striations, to provide a wear edge. The leading edge member  
5 17 may be formed of metal, wood, plastic, or other suitable material.

Advantageously, the leading edge member 17 is easily replaceable. Thus, if the  
leading edge member is damaged, for example by the fork of a fork lift, it can be  
replaced.

Figure 13 illustrates the bottom surface of a bottom deck member 90. As shown, the  
10 bottom deck member comprises a planar component 92 and reinforcing slats 94  
positioned on outer edges of the planar component 92. Openings 96 may be provided  
in the reinforcing slats 94 to provide access to the planar component 92 for the  
purpose of applying rivets or other fasteners through the planar component 92 of the  
bottom deck member 90, as explained below. The exact dimensions of the bottom  
15 deck member 90 is generally unimportant. It is desirable that the thickness of the  
planar member 92 be relatively limited such that the bottom deck member 90 is low  
profile. By being low profile, the bottom deck member 90 does not interfere with lift  
jacks, pallet jacks, etc.

Figure 14 illustrates a rear surface of an end cap 19 for capping the ends of the R-  
20 beam support structures 18, 20. The end cap 19 includes a generally planar outer  
surface 100, R-beam section flanges 102, support section flanges 104, and beam-  
receiving openings 106. The R-beam section flanges 102 are received in the R-beam  
section 24 of the R-beam support structures, or stringers, 18, 20. The support section  
flanges 104 are received by the support section 22 of the R-beam support structures,  
25 or stringers, 18, 20. Conversely, the beam receiving openings 106 of the end caps 19  
receive the beam 32 of the stringers 18, 20. The end caps 19 thus snap onto the  
longitudinal ends of the stringers 18, 20. The end caps 19 cap the ends of the  
stringers 18, 20, provide additional static strength to the metal pallet 10 to resist  
crushing, and provide additional resistance to scissoring or twisting of the side walls  
30 28, 34 of the stringers 18, 20.

The metal pallet structure of the present invention is thus formed as follows:

At least two bottom deck members 90 are positioned at opposite longitudinal ends of the metal pallet structure 10 and generally parallel to one another. More bottom deck members 90 may be provided, however, none should be positioned such that it would

5 interfere with the notch 50 of the side walls 28 of the support section 22 of the R-beam support structures 18. An edge R-beam support structures, or stringer, 18 is provided at each lateral edge of the bottom deck members 90, the edge stringers 18 being positioned generally parallel to one another and perpendicular to the bottom deck members 90. Additionally, a central R-beam support structure, or stringer, 20

10 may be provided generally centrally between the lateral edges of the bottom deck members 90. The bottom deck members 90 are fastened to the stringers 18, 20. This can be done by, for example, riveting (e.g., self-piercing or pop riveting) the bottom deck members 90 to the stringers 18, 20 through the openings 96 provided in the reinforcement slat 94 of the bottom deck member 90. Alternately, the bottom deck

15 members 90 may be fastened to the stringers 18, 20 in any suitable manner including applying an adhesive therebetween, welding, etc.

A first end top deck member 15 is slid into the pockets 44 of the edge R-beam support structures, or stringer, 18 such that the leading side portion 74 of the end top deck member 15 is positioned at a longitudinal end of the metal pallet structure 10. A

20 plurality of central top deck members 14 are slid into the pockets 44 of the stringers 18. The central top deck members 14 may be spaced from one another in any arrangement that does not interfere with the strength of the planar surface provided by the deck members 14, 15. A second end top deck member 15 is slid into the pockets 44 of the edge stringers 18 such that the leading side portion 74 of the end top deck

25 member 15 is positioned at an opposite longitudinal end of the metal pallet structure 10 from that of the first end top deck member 15. The pockets 44 of the edge stringers 18 cover the ends of the top deck members 14, 15, thus minimizing the possibility of entanglement of items with the top deck members 14, 15 or of accidental removal of the top deck members 14, 15. If a central R-beam support

30 structure, or stringer, 20 is provided, the top deck members 14, 15 are centrally

supported by the central stringer 20. The top deck members 14, 15 are positioned generally parallel to one another and generally perpendicular to the stringers 18, 20. The top deck members 14, 15 are fastened to the stringers 18, 20. This can be done by, for example, riveting (e.g., self-piercing or pop riveting) the top deck members 14,  
5 15 to the stringers 18, 20 through the openings 72 provided in the tops 68 and thus through the bottoms 66 of the side portions 62 of the stringers 18, 20. Alternately, the top deck members 14, 15 may be fastened to the R-beam support structures 18, 20 in any suitable manner including applying an adhesive therebetween, welding, etc.

A leading edge member 17 is positioned in the ledge of each leading side portion 74  
10 of the end top deck members 15. The leading edge member is fastened to the end top deck member 15, and the end top deck further fastened to the R-beam support structures 18, 20. This can be done by, for example, riveting (e.g., self-piercing or pop riveting) the leading edge member 17 to the top deck members 14, 15 and thereby to the stringers 18, 20 through the openings 88 provided in the top 80 of the leading  
15 edge member 17 and thus through the bottom 82 of the leading edge member 17. Alternately, the leading edge member 17 may be fastened to the top deck members 14, 15 in any suitable manner including applying an adhesive therebetween, welding, etc.

End caps 19 are snapped onto the longitudinal ends of the R-beam support structures,  
20 or stringers, 18, 20. The end caps 19 may be additionally fastened to the longitudinal ends of the stringers 18, 20 by applying an adhesive therebetween. The end caps may be alternately fastened to the longitudinal ends of the stringers 18, 20 in any suitable manner, for example via welding.

Thus, the metal pallets structure 10 is configured as follows. The at least two bottom  
25 deck members 90 are provided longitudinally, each bottom deck member 90 itself extending laterally. The top decking members 14, 15 are also provided longitudinally, each top deck member 14, 15 itself extending laterally. Replaceable leading edge members 17 are provided at longitudinal ends of the metal pallet structure 10 and supported by the end top decking members 15. End R-beam support

structures, or stringers, 18 are provided at the lateral ends of the bottom deck members 90 and the top deck members 14, 15, generally perpendicular to the bottom deck members 90 and top deck members 14, 15, and separating the bottom deck members 90 from the top deck members 14, 15. The stringers 18 include notches 50 for receiving a fork from a fork lift. A central R-beam support structure, or stringer, 20 may be provided approximately centrally between the lateral ends of the bottom deck members 90 and the top deck members 14, 15 for separating the bottom deck members 90 from the top deck members 14, 15 and providing additional support to the top deck members 14, 15. The central stringer 20 is positioned parallel to the end stringers 18.

The various components of the metal pallet structure may be formed of aluminum or any other suitable material, preferably metal or metallic alloy. By forming the components of aluminum, the metal pallet structure attains the characteristic of quick heating and cooling. This can be particularly useful in the refrigerated or frozen food industry. Further, the various components may be stamped, extruded, or formed in any suitable manner. Extrusion may be an advantageous manner of forming the components insofar as extruded components, such as the R-beam support structures, or stringers, may be easily customized as to length and/or width.

It is to be realized that the optimum dimensional relationships for the parts of the invention, to include variations in size, materials, shape, form, function and manner of operation, assembly and use, are deemed readily apparent and obvious to one skilled in the art, and all equivalent relationships to those illustrated in the drawings and described in the specification are intended to be encompassed by the present invention. Therefore, the foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

Although the present invention has been described with reference to preferred embodiments, persons skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.